1-1-2016

24.0.B.2. Discussion Chemical Reactions

Christopher F. Bauer
University of New Hampshire, chris.bauer@unh.edu

RECORDER REPORT, Chem 444A "Fire & Ice"

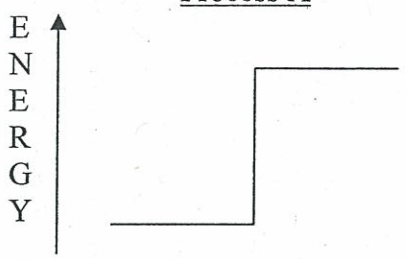
Group Member Name	Role	Date: 4/21/15
Becky	Ambassador	
Samantha	Manager	
Eliza	Recorder	
Nick	Spokesperson	

---

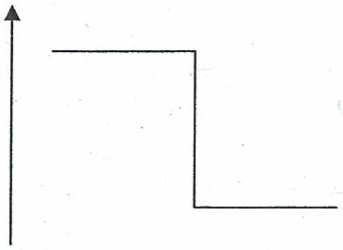
1) Physical differences and temperature change indicated that something was happening after groups mixed their chemicals
2) An interaction between the molecules of two or more reactants that produces a physical and/or chemical change.
   - change in properties (color, texture, volume, phase, etc.)

Chemical reactions relate to energy in two ways, shown by these diagrams

endothermic
Process A



exothermic
Process B



Q1 One process can be described as "going uphill". Which one and why does that make sense?	A) the product requires more energy than the reactant.
Q2 What could the other process be described as?	exothermic — the product requires less energy than the reactant
Q3 Which diagram could be described as "energy is absorbed"? Which could be described as "energy is released"? You learned new terms for these things. What are they?	A: endothermic B: exothermic ✓
Q4 Which posters from Apr 14 were type A and which type B?	A = endo B = exo C = exo D = endo E = exo F = endo ~~D~~ G = endo
Q5 If Process A happened in your hand, what would your hand feel? Explain your response.	Your hand would feel cold because the reaction would pull heat from yar hand. ✓
Q6 If Process B happened in your hand, what would your hand feel? Explain your response.	Your hand would feel hot because ... the product ~~needs~~ has less energy than the reactants. This is the why. This is the what → releases heat which goes to your hand.
Q7 From Tiffany's day (Apr 16): which type of process (A or B) goes along with using coal, crude oil, biodiesel, natural gas, or hydrogen? Explain.	All processes require an exothermic reaction because they release heat when they react. ✓
Q8 What natural process did we talk about that was Type A?	photosynthesis good ✓
Send Ambassador clockwise to check Q5 to Q8 answers with that group.	

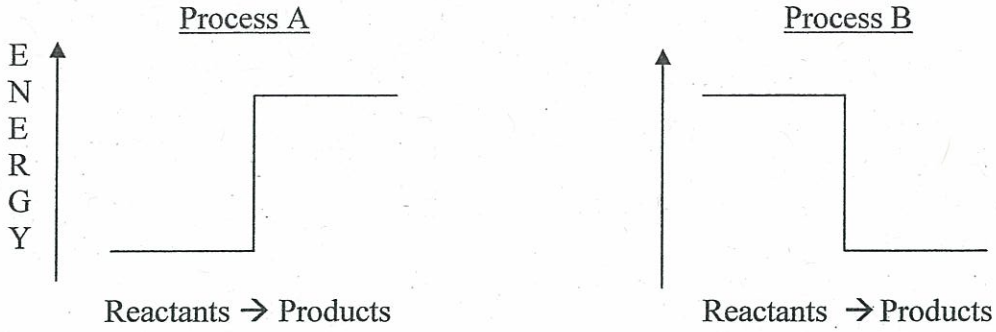
be careful with words. It "has" but "requires" suggests a direction.

endo

exo

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Chemical reactions relate to energy in two ways, shown by these diagrams



3.1 For either type A or type B, how is the amount of heat related to the quantities of reactants (look at poster evidence)?	If there are more reactants in an exothermic reaction more heat is produced. More reactants in an endothermic reaction takes more heat. ✓
3.2 One experiment shows the Limiting Reagent effect: when the extent of reaction is limited by the starting material you have less of. Which poster shows that? Explain.	Poster A shows that the extent of a reaction is limited by the amount of the lesser reactant in proportion to the amount of greater reactant. ✓ Good
3.3 Restate what is happening in Process A and Process B in terms of Potential Energy.	A) The endothermic reaction is a increase in potential energy B) Exothermic reaction is an decrease in potential energy. Good
Send ambassador counterclockwise to share what your group's answer to 3.3 was.	
Share 3.3 answer with instructor.	

heat quantity proportional to chemical amounts

Consider your reaction, showing molecular and structural formulas.
One line indicates a "single bond". Two lines indicate a "double bond". Three is triple.

4.1 I will give you a set of models for the reactants. What must happen in order to get the reactants to become the products?	Bonds must form between the two reactants.
4.2 Do it (change the reactants into the products). Keep track of every change that needs to be made. (You will need this later.)	The bonds must break apart to form H_2O.
4.3 Now we need to relate this to energy. Two group members should shake hands, but hold on as if your life depended on it. A third group member should – carefully – attempt to separate them. What must happen (in terms of energy) in order to separate the hand-shakers?	A greater amount of energy is needed to over power the energy already present. Use a verb that includes direction. "... must be put in..." "... must be provided..."
4.4 What must happen (in terms of energy) in order to separate ANY bonded atoms from each other?	An increase in energy is provided that is greater than the amount of energy (in bond).
4.5 Get a large steel ball, a slab of metal, and a thermochromic sheet. Lay the metal on the table. Put the sheet on that (it should show some non-black color). Put your finger on the sheet to see what color will be produced by a heat input. You observe:	• produces a blue color ✓
4.6 Gently place the steel ball on the sheet for a few seconds. Inspect the resting point for any color change. What do you observe? Does resting a heavy mass on the sheet release any energy?	There is no energy released when a heavy mass is resting on the plate. There is no color change.
4.7 Hold the steel ball about 4 inches above the sheet. Drop it on the sheet. Immediately pick up the ball and inspect the sheet. What do you observe? Does dropping a heavy mass on the sheet release any energy?	The paper changed color when the ball collided with the plate which indicates a release of energy.
4.8 Where did the energy come from?	momentum of collision

combine ideas. Some must break. Some must form.

Caution

start here. Thursday

You need to revisit + pick up with this.

It doesn't take long to get to this from here, but BIG IDEAS here.

4.9 The ball and the Earth were attracted to each other by gravity. When they fall together because of attraction, energy is ... what?	the energy is Released
4.10 What happens (in terms of energy) when ANY pair of atoms fall together (forming a bond) because of a chemical attraction?	Energy is released in the form of heat. ✓
4.11 Summarize your answer to 4.4 and 4.10 here by completing these sentences: When a chemical bond breaks, energy is ... When a chemical bond forms, energy is ...	✓ absorbed released
Send your ambassador to a group not yet visited to see whether you agree on 4.11	
4.12 Calculate the net energy change for going from the reactants to products for your reaction. You need info collected at 4.2, your statements from 4.11, and data from the handout.	2(7.2)+8.3=22.7 4(7.8)=31.2 net= 8.5 ✓ Correct
4.13 Is your reaction endothermic or exothermic and how do you know?	✓ exothermic: product released more energy than reactant absorbed
4.14 Prepare your spokesperson to describe to the class how you did your calculation, and your answers to 4.12 and 4.13.	
Spokesperson presentations (very brief).	
4.15 Describe an exothermic reaction in terms of the relative magnitude of bond energies of reactants and products. (This summarizes the previous questions.) Then do the same for an endothermic reaction. Write your best concise descriptions here.	Exo = energy out > energy in endo = energy in > energy out ✓

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

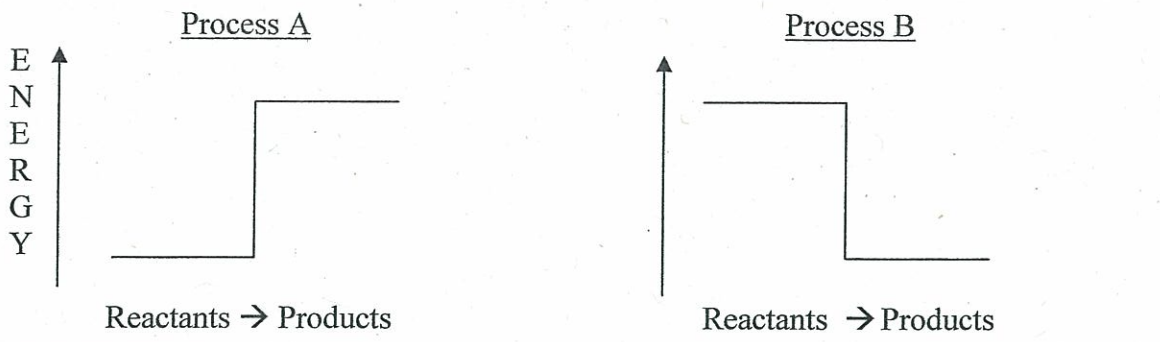
RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: April 21
Emily K	Recorder	
Jacob	Spokesperson	
Charles	Spokesperson	
Sean	Ambassador	
Mandy	Manager	

1) A chemical reaction is when substances are mixed and interact to produce a different substance. - because properties like appearance change It involves a change in energy that we don't have to purposefully input.

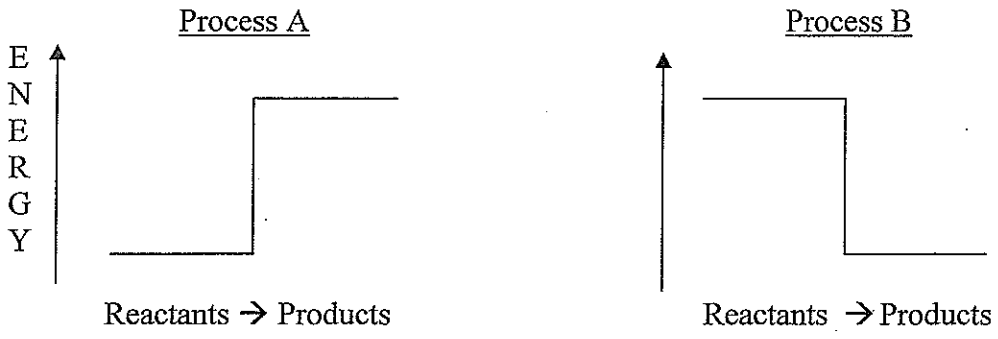
↑ Well, this second sentence is not required in the definition. Depends on what you mean by "we".

Chemical reactions relate to energy in two ways, shown by these diagrams



Q1 One process can be described as "going uphill". Which one and why does that make sense?	Process A because it looks like it is increasing ✓
Q2 What could the other process be described as?	Going Downhill ✓
Q3 Which diagram could be described as "energy is absorbed"? Which could be described as "energy is released"? You learned new terms for these things. What are they?	Absorbing = Process A Releasing = Process B ✓
Q4 Which posters from Apr 14 were type A and which type B?	A = A, D, F, G (endo) B = B, C, E (exo) ✓
Q5 If Process A happened in your hand, what would your hand feel? Explain your response.	Your hand would feel cold b/c energy is being absorbed from hand ✓
Q6 If Process B happened in your hand, what would your hand feel? Explain your response.	Your hand would be warm b/c the reaction is giving off heat. ✓
Q7 From Tiffany's day (Apr 16): which type of process (A or B) goes along with using coal, crude oil, biodiesel, natural gas, or hydrogen? Explain.	They are process B b/c they release energy to power the car ✓
Q8 What natural process did we talk about that was Type A?	Photosynthesis in plants to store energy for use in the plant good
Send Ambassador clockwise to check Q5 to Q8 answers with that group.	

Chemical reactions relate to energy in two ways, shown by these diagrams



3.1 For either type A or type B, how is the amount of heat related to the quantities of reactants (look at poster evidence)?	There will be a greater change in heat when more reactants are mixed together. ✓
3.2 One experiment shows the Limiting Reagent effect: when the extent of reaction is limited by the starting material you have less of. Which poster shows that? Explain.	A - The 1:2 and 2:1 ratios were almost the same as the 1:1 change in temp because once the reactant in smaller quantity runs out, the temp stops changing. ✓ Good
3.3 Restate what is happening in Process A and Process B in terms of Potential Energy.	A) The products have more potential energy than the reactants because the absorb energy B) The products have less potential energy than the reactants because they released energy. * it is chemical potential energy ✓
Send ambassador counterclockwise to share what your group's answer to 3.3 was.	
Share 3.3 answer with instructor.	

Consider your reaction, showing molecular and structural formulas.
One line indicates a "single bond". Two lines indicate a "double bond". Three is triple.

4.1 I will give you a set of models for the reactants. What must happen in order to get the reactants to become the products?	Bonds will have to be broken and new bonds will have to form. ✓
4.2 Do it (change the reactants into the products). Keep track of every change that needs to be made. (You will need this later.)	Did it. ✓
4.3 Now we need to relate this to energy. Two group members should shake hands, but hold on as if your life depended on it. A third group member should – carefully – attempt to separate them. What must happen (in terms of energy) in order to separate the hand-shakers?	The third person has to put in energy to separate the hand shakers. ✓
4.4 What must happen (in terms of energy) in order to separate ANY bonded atoms from each other?	Energy must be put in ✓
4.5 Get a large steel ball, a slab of metal, and a thermochromic sheet. Lay the metal on the table. Put the sheet on that (it should show some non-black color). Put your finger on the sheet to see what color will be produced by a heat input. You observe:	A teal color is produced ✓
4.6 Gently place the steel ball on the sheet for a few seconds. Inspect the resting point for any color change. What do you observe? Does resting a heavy mass on the sheet release any energy?	It is ~~plaid~~ blue under the ball. ~~Resting the ball on the paper doesn't release energy.~~ It does release energy
4.7 Hold the steel ball about 4 inches above the sheet. Drop it on the sheet. Immediately pick up the ball and inspect the sheet. What do you observe? Does dropping a heavy mass on the sheet release any energy?	~~Produced a violet black spot~~. It turns blue It does release energy
4.8 Where did the energy come from?	The mechanical force of the ball hitting the paper ✓

There is a thermal conductivity problem, so this step is "baseline"

You got larger result here

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

4.9 The ball and the Earth were attracted to each other by gravity. When they fall together because of attraction, energy is ... what?	Potential Energy is becoming kinetic energy when the ball is dropped. Energy is released. ✓
4.10 What happens (in terms of energy) when ANY pair of atoms fall together (forming a bond) because of a chemical attraction?	Energy is released. ✓
4.11 Summarize your answer to 4.4 and 4.10 here by completing these sentences: When a chemical bond breaks, energy is ... When a chemical bond forms, energy is ...	breaking = absorbed ✓ form = released ✓
Send your ambassador to a group not yet visited to see whether you agree on 4.11	
4.12 Calculate the net energy change for going from the reactants to products for your reaction. You need info collected at 4.2, your statements from 4.11, and data from the handout.	$7.8 \cdot 10^{-19}$ joules ✓ I agree
4.13 Is your reaction endothermic or exothermic and how do you know?	endothermic – ~~[illegible]~~ the net energy Δ is positive ✓
4.14 Prepare your spokesperson to describe to the class how you did your calculation, and your answers to 4.12 and 4.13.	* Be ready for this.
Spokesperson presentations (very brief).	
4.15 Describe an exothermic reaction in terms of the relative magnitude of bond energies of reactants and products. (This summarizes the previous questions.) Then do the same for an endothermic reaction. Write your best concise descriptions here.	Exo = more energy (in the bonds of the reactants is released than is taken in by ~~[illegible]~~ breaking bonds Endo = more energy is absorbed by ~~breaking~~ bonds than is released

Question: for this reaction, did you expect this answer?

try clearing this up

the word "in" is a problem

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 4/21/15
Kaleigh	spokesperson	
Miriam	Manager	
Jon	Ambassador	
Marisa	Recorder	

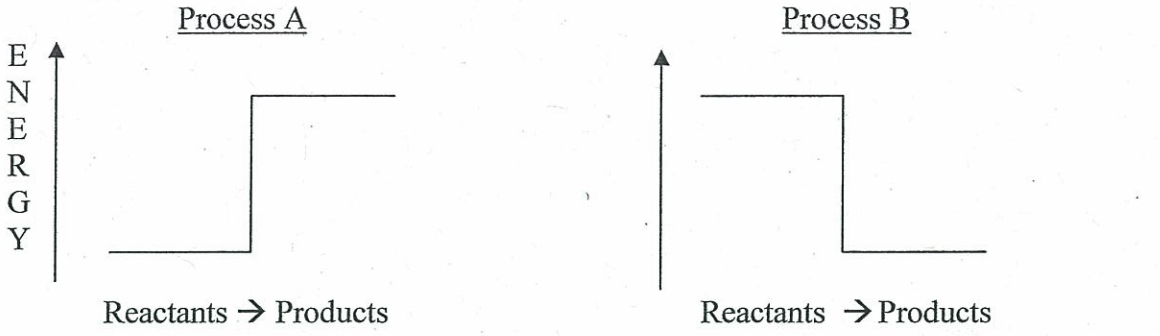
1.2: In the experiments new substances were made from the initial reactants. Some experiments had noticeable changes like bubbling, boiling, fizzing, etc. Characteristic properties are noticeably different. The reactants' characteristics noticeably change.

1.3: Chemical reaction is when two or more reactants combine to create a new substance or substances, referred to as products.

↓

Whose properties are different.

Chemical reactions relate to energy in two ways, shown by these diagrams



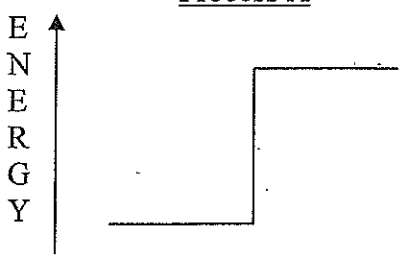
Endothermic Exothermic

Q1 One process can be described as "going uphill". Which one and why does that make sense?	Process A can be described as going uphill. This makes sense because energy starts low and goes high ✓
Q2 What could the other process be described as?	Process B can be described as downhill. ✓
Q3 Which diagram could be described as "energy is absorbed"? Which could be described as "energy is released"? You learned new terms for these things. What are they?	Process A is "energy absorbed" Process B is "energy released" Process A is endothermic Process B is exothermic ✓
Q4 Which posters from Apr 14 were type A and which type B?	Process A: A, D, F, G Process B: B, C, E ✓
Q5 If Process A happened in your hand, what would your hand feel? Explain your response.	Your hand would become cooler because the system is drawing energy from your hand. ✓
Q6 If Process B happened in your hand, what would your hand feel? Explain your response.	Your hand would become warmer because the system would release energy to your hand. ✓
Q7 From Tiffany's day (Apr 16): which type of process (A or B) goes along with using coal, crude oil, biodiesel, natural gas, or hydrogen? Explain.	Process B because combustion gives off heat during its process to create the various substances. ✓
Q8 What natural process did we talk about that was Type A?	Photosynthesis because it takes in energy from the sun. Good
Send Ambassador clockwise to check Q5 to Q8 answers with that group.	

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.

Chemical reactions relate to energy in two ways, shown by these diagrams

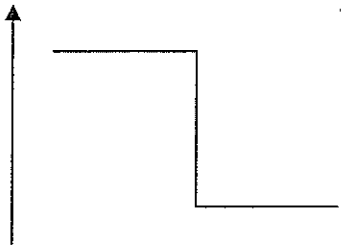
Process A



Reactants → Products

Endothermic

Process B



Reactants → Products

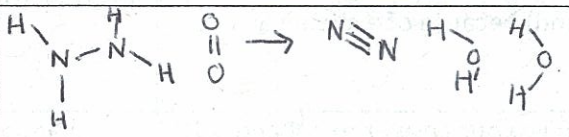
Exothermic

3.1 For either type A or type B, how is the amount of heat related to the quantities of reactants (look at poster evidence)?	With a greater amount of reagant the amount of heat gained or released increases. ✓
3.2 One experiment shows the Limiting Reagent effect: when the extent of reaction is limited by the starting material you have less of. Which poster shows that? Explain.	Poster A shows this because in the ratios 2:1 and 1:2 ~~the are very similar to the~~ the temperature change is very similar to the 1:1 ratio, whereas the 2:2 ratio changed greatly. This means the ratios with a limit (1) did not change as significantly. ✓
3.3 Restate what is happening in Process A and Process B in terms of Potential Energy.	Process A: Potential energy is gained ✓ Process B: Potential energy is released
Send ambassador counterclockwise to share what your group's answer to 3.3 was.	
Share 3.3 answer with instructor.	

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.

Task 4 (20 min max) Chemical Energy, Fire & Ice Chem 444A, Spg 2015, CBauer

Consider your reaction, showing molecular and structural formulas.
One line indicates a "single bond". Two lines indicate a "double bond". Three is triple.

4.1 I will give you a set of models for the reactants. What must happen in order to get the reactants to become the products?	~~Reactants~~ Molecular properties must change and bonds must be broken of the reactants. Bonds are formed to make products and .....
4.2 Do it (change the reactants into the products). Keep track of every change that needs to be made. (You will need this later.)	 ✓
4.3 Now we need to relate this to energy. Two group members should shake hands, but hold on as if your life depended on it. A third group member should – carefully – attempt to separate them. What must happen (in terms of energy) in order to separate the hand-shakers?	The handshake represents a molecular bond. A molecular bond is difficult to break. A lot of energy is required to break it. ✓
4.4 What must happen (in terms of energy) in order to separate ANY bonded atoms from each other?	There needs to be enough energy present to break the bond apart ✓
4.5 Get a large steel ball, a slab of metal, and a thermochromic sheet. Lay the metal on the table. Put the sheet on that (it should show some non-black color). Put your finger on the sheet to see what color will be produced by a heat input. You observe:	Finger on sheet: Bluish/Green ✓
4.6 Gently place the steel ball on the sheet for a few seconds. Inspect the resting point for any color change. What do you observe? Does resting a heavy mass on the sheet release any energy?	The resting point is black. The paper must be giving heat to the ball. Heat is being released from the paper. Energy is not released from the ball. ✓
4.7 Hold the steel ball about 4 inches above the sheet. Drop it on the sheet. Immediately pick up the ball and inspect the sheet. What do you observe? Does dropping a heavy mass on the sheet release any energy?	The resting point turns bluish/green. Yes, dropping a heavy mass on the sheet releases energy. ✓
4.8 Where did the energy come from?	Energy comes from the kinetic energy of the ball falling. ✓ Good

4.9 The ball and the Earth were attracted to each other by gravity. When they fall together because of attraction, energy is ... what?	Energy is ~~transferred~~ released when the two come together ✓
4.10 What happens (in terms of energy) when ANY pair of atoms fall together (forming a bond) because of a chemical attraction?	Energy is ~~transferred~~ released when two atoms come together. ✓
4.11 Summarize your answer to 4.4 and 4.10 here by completing these sentences: When a chemical bond breaks, energy is ... When a chemical bond forms, energy is ...	... gained ✓ ... released
Send your ambassador to a group not yet visited to see whether you agree on 4.11	
4.12 Calculate the net energy change for going from the reactants to products for your reaction. You need info collected at 4.2, your statements from 4.11, and data from the handout.	37 x 10^{-19} gained -46.9×10^{-19} released 9.9 x 10^{-19} net energy released (CORRECT)
4.13 Is your reaction endothermic or exothermic and how do you know?	Exothermic because ~~net~~ energy was released not gained. ✓
4.14 Prepare your spokesperson to describe to the class how you did your calculation, and your answers to 4.12 and 4.13.	
Spokesperson presentations (very brief).	
4.15 Describe an exothermic reaction in terms of the relative magnitude of bond energies of reactants and products. (This summarizes the previous questions.) Then do the same for an endothermic reaction. Write your best concise descriptions here.	An exothermic reaction will have a net energy release (net energy release > energy gained) An endothermic reaction will have a net energy gain (net energy gain > energy released) ✓ good

OK
Pick up from here * on Thursday. Will go quickly.

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

RECORDER REPORT, Chem 444A "Fire & Ice"

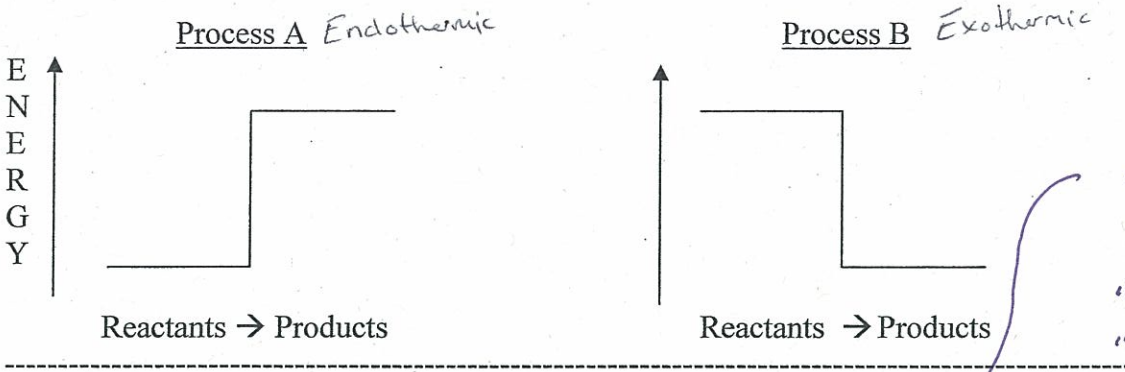
Group Member Name	Role	Date: 4/21
Taylor	Manages	
Calé	Ambassador	
Heathes	Spokesperson	
Emily D.	Recorder	

1.2 For a numbes of experiments there were physical changes that occured. Either two substances were combined and produced another (two ligoids formed a gas) or there was a temperature change. This denotes a reaction.

1.3 A chemical reaction is when two substances interact to produce a substance different than either of the original substances. There is a change in the physical properties that denotes a change.

colr
volume
texture
phase
etc.

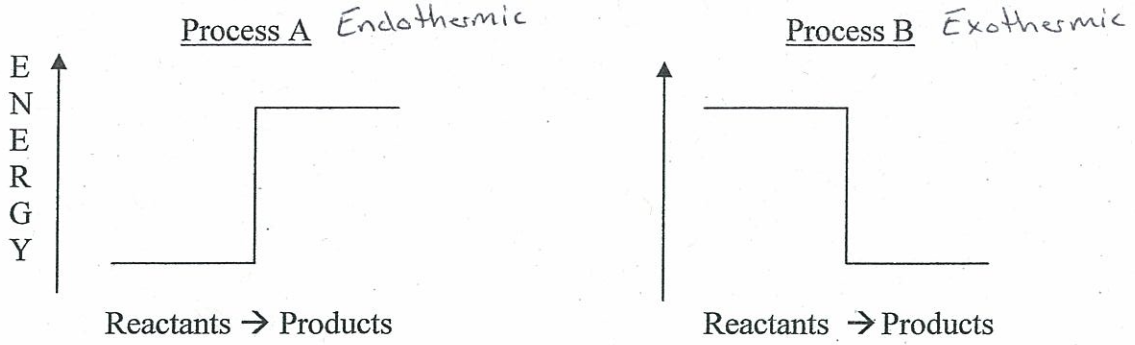
Chemical reactions relate to energy in two ways, shown by these diagrams



Careful with this verb. Use a stronger one "... must be provided..." "... must be input..." to make sure direction is clear

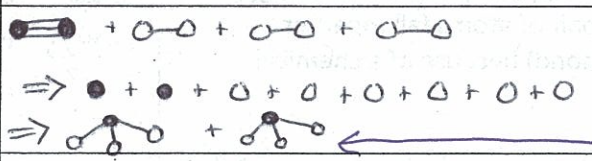
Q1 One process can be described as "going uphill". Which one and why does that make sense?	Process A. Energy is required for the reaction to take place.
Q2 What could the other process be described as?	"Going downhill" Energy is being expelled rather than being used. ✓ ← this works
Q3 Which diagram could be described as "energy is absorbed"? Which could be described as "energy is released"? You learned new terms for these things. What are they?	"energy absorbed" => A This is ~~exothermic~~ endothermic ✓ "energy is released" => B This is exothermic. ✓
Q4 Which posters from Apr 14 were type A and which type B?	A: ~~Barium hydroxide + ammonia nitrate~~ A, D, G, F B: B, C, E ✓
Q5 If Process A happened in your hand, what would your hand feel? Explain your response.	Your hand would feel cold. The chemical reaction is ~~taking~~ utilizing thermal energy. ← Caution again (same reason as above)
Q6 If Process B happened in your hand, what would your hand feel? Explain your response.	Your hand would feel hot. The reaction is causing a release of energy that ~~is~~ exists as thermal energy. ✓
Q7 From Tiffany's day (Apr 16): which type of process (A or B) goes along with using coal, crude oil, biodiesel, natural gas, or hydrogen? Explain.	All of these fuel types are used in ~~exother~~ exothermic processes to produce energy. The energy within the bonds is being utilized when bonds are broken. ✓
Q8 What natural process did we talk about that was Type A?	Photosynthesis is a process that "absorbs" energy. The radiant energy from the sun is used for growth processes. Good
Send Ambassador clockwise to check Q5 to Q8 answers with that group.	

Chemical reactions relate to energy in two ways, shown by these diagrams



3.1 For either type A or type B, how is the amount of heat related to the quantities of reactants (look at poster evidence)?	For both types of reactions there was a greater energy transfer (greater energy change) when more reactants were present. ✓ Energy proportional to chemical quantities
3.2 One experiment shows the Limiting Reagent effect: when the extent of reaction is limited by the starting material you have less of. Which poster shows that? Explain.	Poster D shows this. When only one scoop of ammonium chloride was present, the temperature only dropped by 0.2°C. When more was present, a greater temperature change was able to take place. OK; poster A has the best example
3.3 Restate what is happening in Process A and Process B in terms of Potential Energy.	In process A, energy is being absorbed and bonds are being formed. These bonds represent potential energy. This is greater than in the reactants. In process B, energy is being released because bonds are being broken! The potential energy of the products is less than that of the reactants. ✱ Caution here: ~~Bonds~~ is taken up in part 4 more explicitly
Send ambassador counterclockwise to share what your group's answer to 3.3 was.	You don't need to invoke it here, (just repeat as
Share 3.3 answer with instructor.	A: Increase in P.E. B: Decrease in P.E.

Consider your reaction, showing molecular and structural formulas.
One line indicates a "single bond". Two lines indicate a "double bond". Three is triple.

4.1 I will give you a set of models for the reactants. What must happen in order to get the reactants to become the products?	Bonds must be broken in order to form new bonds between different atoms. ✓
4.2 Do it (change the reactants into the products). Keep track of every change that needs to be made. (You will need this later.)	 ✓
4.3 Now we need to relate this to energy. Two group members should shake hands, but hold on as if your life depended on it. A third group member should – carefully – attempt to separate them. What must happen (in terms of energy) in order to separate the hand-shakers?	The energy that the third person puts into breaking the handshake must be greater than the energy used by the two people shaking hands in order to pull them apart. ✓
4.4 What must happen (in terms of energy) in order to separate ANY bonded atoms from each other?	The energy being put into the system to break them apart must be greater ✓ than that holding two atoms together.
4.5 Get a large steel ball, a slab of metal, and a thermochromic sheet. Lay the metal on the table. Put the sheet on that (it should show some non-black color). Put your finger on the sheet to see what color will be produced by a heat input. You observe:	When the paper was placed on the metal, the edges turned blue. When heat was added (hands placed on it) there was red, yellow, and green ✓ color changes
4.6 Gently place the steel ball on the sheet for a few seconds. Inspect the resting point for any color change. What do you observe? Does resting a heavy mass on the sheet release any energy?	There was no color change. Resting a heavy mass on the sheet did not release any energy. ✓
4.7 Hold the steel ball about 4 inches above the sheet. Drop it on the sheet. Immediately pick up the ball and inspect the sheet. What do you observe? Does dropping a heavy mass on the sheet release any energy?	There was a green/yellow/ red color change. Dropping a heavy mass on the sheet releases energy. ✓
4.8 Where did the energy come from?	The energy came from the movement of the ball. Up high, it had potential energy. Then it dropped and the energy was ~~used~~ released. ✓ Good

Do you know what this is?

must match
Can't put in more than the strength, but some energy could be "left over"

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

4.9 The ball and the Earth were attracted to each other by gravity. When they fall together because of attraction, energy is ... what?	when the ball is held up high it has potential energy. When it falls, the energy exists as kinetic energy. When it hits the table there is an energy transfer from the ball to the table / the photochromic paper. ✓
4.10 What happens (in terms of energy) when ANY pair of atoms fall together (forming a bond) because of a chemical attraction?	when two atoms "fall" together, energy is released. ✓
4.11 Summarize your answer to 4.4 and 4.10 here by completing these sentences: When a chemical bond breaks, energy is ... When a chemical bond forms, energy is ...	when a chemical bond breaks, energy is absorbed. ✓ When a chemical bond forms, energy is released. ✓
Send your ambassador to a group not yet visited to see whether you agree on 4.11	
4.12 Calculate the net energy change for going from the reactants to products for your reaction. You need info collected at 4.2, your statements from 4.11, and data from the handout.	$N\equiv N + 3(H-H) \Rightarrow$ ~~2 (NH3)~~ $2\left(\begin{smallmatrix} & N & \\ H & & H \\ & H & \end{smallmatrix}\right)$ $15.7 + 3(7.2) \Rightarrow$ Co(a.5) $37.3 \Rightarrow 39$ difference = 1.7 joules ✓
4.13 Is your reaction endothermic or exothermic and how do you know?	~~Exothermic~~ ~~Endothermic~~, because ~~the products have more potential energy than the reactants.~~ Energy ~~must~~ ~~be put into the system.~~
4.14 Prepare your spokesperson to describe to the class how you did your calculation, and your answers to 4.12 and 4.13.	the output of energy is greater than the input. ✓ (X) Will start here Thursday,
Spokesperson presentations (very brief).	
4.15 Describe an exothermic reaction in terms of the relative magnitude of bond energies of reactants and products. (This summarizes the previous questions.) Then do the same for an endothermic reaction. Write your best concise descriptions here.	Exothermic → energy is released → bonds are (being formed) The energy of the reactants is less than that of the products. Endothermic → energy is absorbed → bonds are (being broken). The energy of the reactants is ~~less than~~ greater than that of the products.

becomes

Very nice

Not exactly right. Rethink vs your reaction according to 4.12

RECORDER REPORT, Chem 444A "Fire & Ice"

Group Member Name	Role	Date: 4/21/15
Tim	Manager	
Amanda	Recorder	
Emma	Ambassador	
Kyle	Spokesperson	

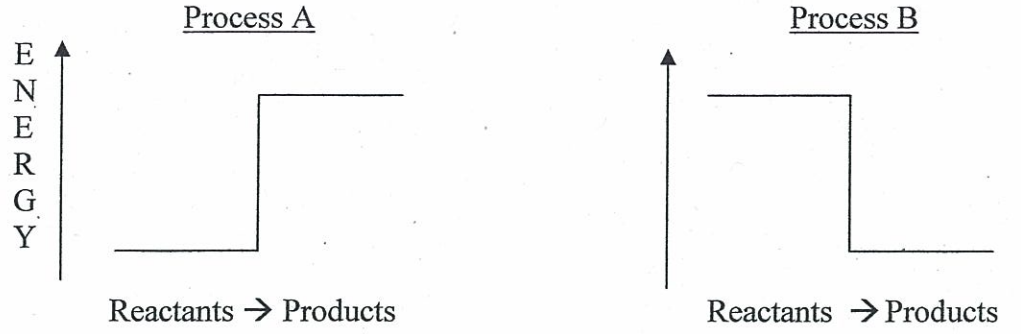
Task 1:

- Physical changes, changes heat or color, scent are all evidence a chemical reaction has occured.
- Chemical reaction is when the reactants break bonds/ form new bonds to form a new substances with new chemical properties.
  - two or more things mixed together and have a physical change.

The key issue is "properties change" in a substantial way (color, texture, volume, phase, etc)

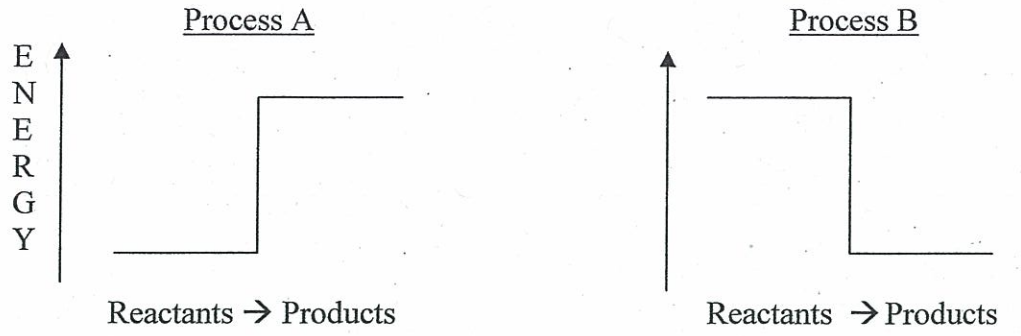
Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.

Chemical reactions relate to energy in two ways, shown by these diagrams



Q1 One process can be described as "going uphill". Which one and why does that make sense?	process A because it is going from low to high
Q2 What could the other process be described as?	"downhill"
Q3 Which diagram could be described as "energy is absorbed"? Which could be described as "energy is released"? You learned new terms for these things. What are they?	process A = energy absorbed process B = energy released endothermic + exothermic
Q4 Which posters from Apr 14 were type A and which type B?	Type A: A, D, F, G (endothermic) Type B: B, C, E (exothermic)
Q5 If Process A happened in your hand, what would your hand feel? Explain your response.	Cold, because your hand is absorbing heat reconsider
Q6 If Process B happened in your hand, what would your hand feel? Explain your response.	warm, because your hand is releasing heat
Q7 From Tiffany's day (Apr 16): which type of process (A or B) goes along with using coal, crude oil, biodiesel, natural gas, or hydrogen? Explain.	process B because they release the energy needed to run cars, etc.
Q8 What natural process did we talk about that was Type A?	photosynthesis good
Send Ambassador clockwise to check Q5 to Q8 answers with that group.	

Chemical reactions relate to energy in two ways, shown by these diagrams



3.1 For either type A or type B, how is the amount of heat related to the quantities of reactants (look at poster evidence)?	The greater the quantity of reactants, the greater the change in temperature. ✓
3.2 One experiment shows the Limiting Reagent effect: when the extent of reaction is limited by the starting material you have less of. Which poster shows that? Explain.	Poster A because the temperature didn't change even though one of the reactants was doubled. ✓ right, but you didn't have enough of the reagent not doubled
3.3 Restate what is happening in Process A and Process B in terms of Potential Energy.	In process A the potential energy of the products was greater than that of the reactants so energy was absorbed. For process B the potential energy of the products was less than that of the reactants because energy was released. good ✓
Send ambassador counterclockwise to share what your group's answer to 3.3 was.	
Share 3.3 answer with instructor.	

Consider your reaction, showing molecular and structural formulas.
One line indicates a "single bond". Two lines indicate a "double bond". Three is triple.

4.1 I will give you a set of models for the reactants. What must happen in order to get the reactants to become the products?	The bond must break and form new ones. ✓
4.2 Do it (change the reactants into the products). Keep track of every change that needs to be made. (You will need this later.)	$2O_2 + CH_4 \rightarrow 2H_2O + CO_2$ list each bond broken + each bond formed
4.3 Now we need to relate this to energy. Two group members should shake hands, but hold on as if your life depended on it. A third group member should – carefully – attempt to separate them. What must happen (in terms of energy) in order to separate the hand-shakers?	There has to be enough energy in order to seperate the bond. ✓
4.4 What must happen (in terms of energy) in order to separate ANY bonded atoms from each other?	you need energy to break the bond. (use a better word, like Energy must "go in" or "be absorbed" so direction is clear.
4.5 Get a large steel ball, a slab of metal, and a thermochromic sheet. Lay the metal on the table. Put the sheet on that (it should show some non-black color). Put your finger on the sheet to see what color will be produced by a heat input. You observe:	The color changes to show the transfer of heat ✓
4.6 Gently place the steel ball on the sheet for a few seconds. Inspect the resting point for any color change. What do you observe? Does resting a heavy mass on the sheet release any energy?	Green in middle, orange on outside, small dot. Yes because there is a transfer of heat.
4.7 Hold the steel ball about 4 inches above the sheet. Drop it on the sheet. Immediately pick up the ball and inspect the sheet. What do you observe? Does dropping a heavy mass on the sheet release any energy?	More colors appear. Yes because the metal absorbs the energy from the ball. It has a more intense color. ✓
4.8 Where did the energy come from?	potential energy of holding it (the fall)

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

4.9 The ball and the Earth were attracted to each other by gravity. When they fall together because of attraction, energy is ... what?	released / becomes Kinetic energy. ✓
4.10 What happens (in terms of energy) when ANY pair of atoms fall together (forming a bond) because of a chemical attraction?	Energy is released ✓
4.11 Summarize your answer to 4.4 and 4.10 here by completing these sentences: When a chemical bond breaks, energy is ... When a chemical bond forms, energy is ...	absorbed ✓ released ✓
Send your ambassador to a group not yet visited to see whether you agree on 4.11	
4.12 Calculate the net energy change for going from the reactants to products for your reaction. You need info collected at 4.2, your statements from 4.11, and data from the handout.	reactant: $4(6.9)+2(8.3) = 44.2\times10^{-19}$ Joules ✓ product: $4(7.8)+2(13.3) = 57.8\times10^{-19}$ Joules ✓
4.13 Is your reaction endothermic or exothermic and how do you know?	exothermic because more energy came out than was absorbed. Good
4.14 Prepare your spokesperson to describe to the class how you did your calculation, and your answers to 4.12 and 4.13.	Will do Thursday
Spokesperson presentations (very brief).	
4.15 Describe an exothermic reaction in terms of the relative magnitude of bond energies of reactants and products. (This summarizes the previous questions.) Then do the same for an endothermic reaction. Write your best concise descriptions here.	Exothermic: bond energy's of the product are greater than the reactants Endothermic: bond energy's of the product are less than the reactants

Excellent

Christopher F. Bauer, Principal Investigator.
This material is based upon work supported by the National Science Foundation under Grant No. 1245730.
Any opinions, finding and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.